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Corporate Bonds or Bank Loans: Debt Structure and its Determinants in the U.S. Market

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Abstract

This study advances the research on the U.S. corporate debt market by investigating a large sample of firms for the period from 2003 to 2018. I show that a substantial part of U.S. firms' debt is financed by outstanding bonds. Further, with regression analysis, I prove that firms which are less profitable, which have lower growth opportunities, lower leverage, and more cash reserves show a higher bond ratio. Also, a non-linear relationship for the size of a firm with the proportion of bond financing is revealed which implies that very small and very large firms have lower bond ratios. As one of few studies, I also show that firms utilize additional capital raised from bonds to invest in growth opportunities rather than keeping this capital as cash reserves on the balance sheet. Throughout the analysis, this study places special importance on the difference between the time before and after the Great Financial Crisis of 2008. With my results, I provide important implications for policymakers to define the future of the bond market and to answer the question on which firms should have access to it.

Keywords: bond ratio; corporate bond; debt choice; debt structure; capital structure; pecking order theory; investment

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1 Introduction

The post-crisis period has experienced a considerable shift towards the bond market which is especially observable for non-financial companies (Sakoui and Bullock 2009; Avdjiev et. al 2017; Çelik et. al 2019). This shift has been favored by cut-backs in credit supply from banks and low interest rates. In specific, the international credit market experienced a shift from bank loans to debt securities, where the latter share rose substantially from 48% in 2008 to 57% in 2018 (Aldasoro and Ehlers 2018). The increased use of corporate bonds has as well been, in many economies, supported by regulatory initiatives (Çelik et. al 2019). Regarding the just mentioned trends, it is important to understand which firms finance themselves largely from the bond market and what the additional funding is utilized for.

With time-series plots and fixed-effects regression analysis, I answer the research questions on how U.S. firms finance themselves, i.e. what the proportion of bonds in their capital structure is, which firms finance themselves largely from the bond market and which determinants explain the choice of debt structure for firms in the U.S. Lastly and importantly, with dynamic regression analysis on the change of the bond ratio, I am seeking to understand how companies are employing the proceedings from corporate debt issuance.

The results indicate that a substantial part of U.S. firms' debt is financed with outstanding bonds. Regression analysis reveal that firms which are less profitable, which have lower growth opportunities, lower leverage, and higher cash reserves show a higher bond ratio. The relationship with size and bond ratio is found to be non-linear, bell-shaped. This implies that very small and very large firms have lower bond ratios whereas companies which size lies in between have higher bond ratios. Interestingly, the relationships between the dependent variable and the classification of whether a firm is investment-grade or not and the distinction between the period before and after the financial crisis are positive and firm-specific. Overall, the results are in line with the pecking order theory of capital structure which states that a firm's capital structure decisions are driven by the degree of information asymmetry implying that firms with less internal funds make more use of bond financing as their other financing options are used up earlier. A very important finding

of this study is that additional capital raised from bonds harms profitability in the short-term and that it has a positive effect on investments on a longer time frame. This implies that firms invest funds raised from bonds in growth opportunities rather than keeping them as cash reserves on the balance sheet. Yet, it also reveals that bond financing does not improve a firm's profitability in the long-run. Overall, this positive effect that the change in bond ratio has on investment is driven by the period before the Great Financial Crisis and not observable afterwards.

My work adds value to the current body of research by assessing the debt structure with the measure bond ratio and placing a special attention on the time before and after the financial crisis, motivated by it representing a trigger point for the corporate financing with bonds. To the best of my knowledge, this study is one of few researches that investigates how additional funding of bonds impacts investment behaviour, cash, and profitability by assessing dynamic regressions.

In the literature, there exist many studies that investigate the determinants of capital structure and there is also a large body of literature on the choice of private and public debt, hence on the debt structure. Faulkender an Petersen (2006) document that, after controlling for a large set of relevant firm characteristics, differentiation across types of debt seems to substantially affect a firm's capital structure. They find that firms which have access to public markets enjoy higher debt capacities than firms that can only access the private debt markets, and hence are less likely to underleverage.

In a more recent study, Kale and Meneghetti (2011) provide a synthesis of results for this area of research and conclude that the choice between public and private debt is governed by four basic factors. Firstly, the degree of certification a company needs, secondly, the potential leakage of valuable proprietary information, thirdly, the preference for private bank debt when monitoring of managerial actions generates value, and lastly, the flexibility in bank debt to renegotiate the contract terms in times of distress. Based on a large sample of U.S. firms from 2002 to 2009, Colla et. al (2013) highlight the dominant role of bond capital in a firm's debt structure. Their central finding is that most firms, around 85% of their sample, borrow mainly with one type of debt indicating a

tendency toward specialization in debt. Morellec et. al (2015) study the choice between bonds and bank loans in the light of a firm's financing decisions. They find that companies with higher growth potential, with a more favourable negotiation position, which are subject to lower credit supply, or which operate in more competitive environments, are more probable to raise money from bonds.

Further, for example, Bharath et al. (2009) prove that asymmetric information drives capital structure for U.S. firms between 1973 and 2002. Likewise, Gomes and Phillips (2012) show that asymmetric information plays an important role in why public firms issue private or public securities. In specific, they reveal that a company's probability to issue debt increases with asymmetric information while it decreases for the issuance of equity.

The broad topic of capital structure and debt structure is also discussed by Rauh and Sufi (2010) who stress the importance of debt heterogeneity and focus on the credit quality of firms. The authors find that low-credit-quality firms are more likely to spread the priority of their capital structure than high-credit quality firms. Several years earlier, Bolton and Freixas (2000) show in their research paper about equity, bonds, and bank debt that in an equilibrium state riskier firms prefer bank loans while the safer ones prefer the financing with bonds. Firms which lie in the middle choose to issue both equity and bonds. A very recent study by Albrizio et. al (2019) examines market responses to monetary policy announcements taking into account U.S. corporate bond data between 2003 and 2016 and the role and trend of high-yield bonds. They find that unconventional monetary policy has increased investors' appetite for high-yield U.S. corporate bonds, consequently altering the access for high-yield firms to the market.

As reviewed, many studies explore the choice between public and private debt often by applying logit regressions models, hence focusing on the probability of the choice. This study, in contrast, assesses the debt structure with the level of bond ratio and places special focus on the time before and after the financial crisis. It further analyses the impact of the change of bond ratio on investment, cash-holdings, and profitability with the goal to understand how companies are employing the proceedings from corporate debt issuance.

The rest of the paper is organized as follows. Section 2 provides an overview of the data sample and variables. In Section 3, the empirical results are discussed and for the regression analysis subdivided into main results and further analysis with focus on the time before and after the financial crisis. Lastly, Section 4 concludes on the main findings and concepts and provides an outlook for future research.

2 Data overview

2.1 Data description

I study firm financials and bond-issuances of U.S. public firms for the time period January 2003 to December 2018 on a quarterly basis. Firm accounting data is retrieved from the CRSP/Compustat Merged (CCM) database whereas for the bond issuances Mergent's Fixed Income Securities Database (FISD) is accessed. Both databases are provided by the Wharton Research Data Services (WRDS), an online academic resource for bulk access to stock market, company financial, and economic data. When matching CCM with Mergent's FISD data, the selection of bonds included in the final data sample follows the linking logic provided by the Wharton Research Data Services (WRDS). This procedure ensures the correct matching of firm-characteristics and bonds by imposing a conservative date range for Compustat financials to which a specific bond-issue can be linked (WRDS 2017). As the reporting of bond-issuances for the year 2019 was incomplete for the point in time this study was conducted, the data sample limits itself to the end of the year 2018 (Appendix Table 5). Following the standard practice in literature, I exclude financial firms (Standard Classification (SIC) codes 6000-6999) and utilities (SIC codes 4900-4999). I also remove firm-quarters with missing or zero values for total assets, firm-quarters with missing or zero values for total debt, and missing values for the control variables of interest. The final data sample consists of 51,261 firm-quarter observations. Variable definitions are provided in the Appendix in Table 6 and all ratios are winsorized at the 1% and 99% level to minimize the impact of data errors and outliers.

Appendix Table 7 shows that, on average, U.S. firms between 2003 and 2018 have 69.2% of

their debt financed by outstanding bonds, with a minimum value of 28.4% and a maximum value of 100%. Regarding the balance sheet size of the firms present in my sample, the average amount of assets for the firms amounts to roughly USD 14,886 million, with a broad range of a minimum total assets of USD 2,0 million to USD 534,870 million. Further, on average, firms in my sample have a market leverage of 22.9% and a market-to-book value of 1.345, indicating that the firms are overvalued, hence that they show growth opportunities.

In order to provide a better understanding on which bonds are included in the final dataset after applying the WRDS linking logic, Appendix Table 8 summarizes the bond-issues included in the sample, showing the number of issues and the aggregated offering amount of those bond issuances per year. After matching Mergent's FISD bond-issuances to Compustat financials, there is no considerable difference or trend noticeable between the different years regarding the number of issuances and the sum of offering amounts. This is due to the linking logic which drops out issuances that cannot be accurately matched. However, when considering the entire Mergent's FISD dataset before matching it to the Compustat financials (Appendix Table 5), there is a clear trend noticeable that the number of issuances and likewise the aggregated amount of offering amounts increased substantially by 2018. In specific, the number of issuances increased by roughly 3.4 times from 4,973 to 16,713, whereas the aggregated offering amount increased by roughly 1.4 times from USD 717.36 billion to USD 1025,17 billion from 2003 to 2018. This demonstrates a considerable increase of bond activity and that, on average, smaller but more bonds are issued over time.

2.2 Calculation of the variable of interest bond ratio

The bond ratio, my variable of interest, is calculated as follows:

$$Bond\ ratio_t = \frac{\sum Outstanding\ bonds_t}{Total\ debt_t} \tag{1}$$

The outstanding amount of bonds is chosen, in contrast to the offering amount, as it gives the correct amount of outstanding bonds for each quarter. This ensures a more accurate representation of the debt structure for a firm at each point in time. When applying the calculation, several observations return a bond ratio which is greater than one hundred percent, possibly caused by delays in reporting the issued bonds in the total debt. Those observations, which show bond ratios greater than one hundred percent, are set to one hundred percent with the justification that those firms finance a very large part of their debt by bonds. Further, when testing another approach on the assessment of the independent variable, both methods yielded the same results in the later following regression analysis. This stated approach would have been to assign the bond ratio into quintiles, with the goal to define companies that have very low, low, medium, high, or very high bond ratios into clusters.

3 Empirical Evidence and Discussion

3.1 Development of the bond ratio

In order to analyze how U.S. firms finance themselves, that means what their proportion of public debt in their capital structure is and how that debt structure evolved over time, I plot several time-series graphs for my period of interest from 2003 to 2018.

The time-series graph in Appendix Figure 2 illustrates the development of the average bond ratio for U.S. firms over the sample period. Overall, the level of bond ratio is fairly stable and fell slightly from 67.4% in the first quarter of 2003 to 64.6% in the fourth quarter of 2018. The bond ratio was highest before and after the Great Financial Crisis of 2008 with a maximum of 73.0% in the third quarter of 2005 and 72.7% in the first quarter of 2010. The steep increase in the level of bond ratio in the first quarter of 2010 is most likely due to the substitution for bank loans as a consequence of the financial crisis when credit supply was tight. A similar development was found by De Fiore and Uhlig (2015) for the euro area. They found a counteracting development for bank loans and debt securities throughout and after the financial crisis of 2008 (De Fiore and Uhlig 2015). The slight drop of the bond ratio close to 2009 might be explained by the firms' preference for bank debt when the flexibility to renegotiate debt contracts is valuable, which is the case during financial distress and in times of crisis (Kale and Meneghetti 2011).

Considering the weighted average for the bond ratio by size, in Appendix Figure 3, the development is slightly different and indicates a clear increase in the bond ratio from 2003 to 2018, where the bond ratio lies between 51.9% and 66.1%. This weighted development is also very well illustrated in Appendix Figure 4 which shows the proportion of total debt taken by outstanding bonds in USD billion in a stacked line graph. An explanation for the recent and future trend of rising bonds in the financing structure is that companies choose bonds for cheap funds due to the currently low-interest rates and increasing inflows into fixed-income funds. While the cost of capital for banks is increasing, the cost of bond market funding is at an all-time low for some companies (Sakoui and Bullock 2009). To sum it up, the graphs provide evidence that a substantial part of U.S. firms'

debt is financed by outstanding bonds for the entire sample period. In particular, between 50% and 66% of the debt is financed by outstanding bonds in absolute terms, whereas disregarding the size of a firm, the average bond ratio ranges between 65% and 73% on an aggregated yearly basis. The lower percentage of bond financing for the weighted approach is explained by the fact that the very large firms in the sample have a comparably low bond ratio. This pattern is further proved and analyzed in a cluster analysis in the next paragraph which is conducted to better understand the structure and characteristics of the analyzed data set.

Cluster analysis is a technique commonly used to discover unknown structures and patterns in data sets. The k-means clustering approach aims to minimize within-cluster variances, which means the squared Euclidean distances of a firm-year observation from the center of its own cluster. It further maximizes the variances between those clusters. Applying the elbow method to determine the optimal number of clusters yields four final clusters for the data set (Appendix Figure 10). Implementing this approach, the within-cluster sum of squares ist plotted for different values of clusters. The location of a bend, or knee, in the plot, is a good indicator of the appropriate number of clusters (Kaufman and Rousseeuw 1990; Everitt and Hothorn 2005).

Cluster 1 with 43,534 observations is the largest, representing 85% of the data sample and has an average bond ratio of 74.8%. All the other clusters represent a smaller subset of the data sample and distinguish themselves mainly by being firms with larger size. The second biggest cluster, Cluster 2, with 6,026 observations, has an average bond ratio of 71.5% and represents 12% of the dataset. Cluster 3 has 1,345 observations, corresponding to 3% of the dataset, and shows an average bond ratio of 48,5% whereas the very smallest cluster, Cluster 4, with 356 observations shows an average bond ratio level of 46.4%. It is noteworthy that firms in the smallest cluster are mainly firm-observations from very large corporations such as Apple Inc., Toyota, Microsoft, Verizon, British Petroleum, Chevron, Exxon Mobile, Ford, ATT, Vodafone, Total S.A., Petroleo Brasileiro S.A., and General Motors.

To summarize, the cluster analysis gives a first indication that very large firms have a lower

bond ratio while 85% of the firms in the sample are fairly similar. Further, it is interesting to note that the smaller clusters, hence the larger firms, are those which are more likely to pay dividends, to have an investment-grade rating, and to have higher cash-flows.

With my second research question, I want to understand whether certain industries rely more on the public debt market. Further, I analyze whether and which differences there are for higher or lower-rated companies to access the financing with bonds. For the latter split, the expectation is that higher-rated firms have easier access to the market. Hence, those firms should also finance themselves more with corporate bonds.

Appendix Figure 6 provides time-series evidence for the industry split. All industries' development of the bond ratio lies fairly close together. On average, the Construction and Mining industry has the highest bond ratio development and Transportation & Communication shows the lowest bond ratio. The other industries which are Agriculture, Forestry and Fishing, Manufacturing, Services, Retail Trade and Wholesale Trade lie in between in the stated order. The Agriculture, Forestry and Fishing industry is excluded from the graph due to irregular reporting of their financials or bond issuances. It is noticeable that it is the capital-intensive industries Construction, Mining and Manufacturing that show the highest proportion of bond financing.

In Appendix Figure 7, I plot the average bond ratio split by whether a firm is considered investment-grade or not and an interesting trend is observable. Whereas before the Great Financial Crisis high-yield firms financed themselves with a slightly larger proportion of bonds, after 2009 this trend switched and the bond ratio of investment-grade firms increased. This can be explained with the fact that investment-grade firms increased their issuance of bonds post-crisis in order to substitute the shortage of bank loans.

Appendix Fgure 8, which measures the weighted bond ratio by the size of a firm, shows that investment-grade firms have a consistently higher bond ratio which increases over time whereas the percentage of bonds in debt remains stable and around 50% for high-yield firms. This development is in line with the expectation that investment-grade firms have easier access to the market

and hence hold a higher proportion of bonds in their debt structure. The difference in Figure 7 and Figure 8 in the Appendix can be explained by the findings of the previously conducted cluster analysis that larger firms show a higher likelihood for investment-grade rating which in consequence shifts the line for investment-grade firms upwards for the weighted approach. As probably more firms were rated investment-grade before the crisis and were down-graded afterwards, this shift for the weighted-approach occurred more strongly for the period before 2008. Further, an explanation for the increasing trend of bond ratio for investment-grade firms while the high-yield line remains fairly constant is the following. Those firms that have easier access to the market, namely higher-rated firms, can more easily increase their percentage of bonds in the debt structure. In other words, investment-grade firms can take advantage of the benefits of bond funding while in comparison high-yield-firms prefer private debt, probably also due to an information advantage and a better renegotiation position regarding debt contracts (Kale and Meneghetti 2011).

Overall, Construction, Mining and Manufacturing show on average the highest bond ratio over the sample period. Further, firms that are considered investment-grade show higher financing with bonds, especially with a shift after the financial crisis of 2008.

3.2 Regression analysis on the level of bond ratio

The time-series graphs give a first idea of how the funding with bonds developed over time and what role the industry and the rating of a firm play. However, these findings are not enough to draw statistically valid conclusions. With the third research question, I want to focus on which determinants explain the choice of debt structure for firms in the United States. For that, I run panel regressions on my data set accounting for different linear grouped fixed-effects by firm, industry, and quarter represented by different columns in the regression tables. I further implement robust and multi-way clustered standard errors for every level. The regression equation of interest is as follows where the indexes 'i' and 't' indicate the firms and the year-quarters respectively:

$$\begin{aligned} Bond\ ratio_{it} = Profitability_{it} + Size_{it} + Size^2{}_{it} + Market - to - book\ value_{it} \\ + Market\ leverage_{it} + Dividends_{it} + Tangibility_{it} + Cash - flow_{it} \\ + Cash - holdings_{it} + IG_{it} + GFC_{it} \end{aligned} \tag{2}$$

The regression results for my main regression are reported in Table 1. For all specifications in Table 1, the bond ratio of a firm is negatively related to the size, the market-to-book value and the market leverage of a firm. The negative relationship with profitability is also significant but at the lower 10% significance level. These results show a strong statistical significance. For the variable size, additionally, a significant non-linear relationship is proved by regressing the squared value of size. Likewise, the cash-holdings of a firm are positively related to the bond ratio across all specifications with high statistical significance. For the dummy variable whether an observation occurred before the Great Financial Crisis or after (GFC), all specifications except the last one in column (6) with firm-quarter fixed-effects show a significant positive relation. The remaining control variables, dividends and cash-flow show inconsistent results in terms of relationship and significance. The dummy variable IG is not significant for specifications with firm fixed-effects, yet shows a consistently positive relation with the level of bond ratio for all other models.

It is interesting to note that for the significant coefficients, the results of the dependent variable bond ratio are very similar to the regressions with the capital structure ratio market leverage as a dependent variable (Appendix Table 9). This confirms the nature of the bond ratio, which is likewise considered a capital structure ratio, on the debt-level. Further, this point is supported by the fact that the variable market leverage has the highest impact on the dependent variable which can be retrieved from the level of the coefficient. The two variables showing the highest magnitude are size and cash-holdings. For the market leverage for example, if the ratio increases by one hundred percent, the bond ratio decreases by roughly 0.7 decimal points, or 70%. Likewise, if size increases by one hundred percent, the bond ratio decreases by roughly 19%. For cash-holdings, a coefficient around 0.18 decimal points implies that if the cash-holdings ratio increases by one hundred per-

cent, the proportion of outstanding bonds in total debt increases by 18%. Market-to-book value has a comparably lower impact with a coefficient around minus 0.05 decimal points. This magnitude implies that if the market-to-book value increases by one hundred percent, the level of bond ratio decreases by approximately 5%. The relationship of the profitability of a firm with its bond ratio is only significant at the 10% level, yet shows a relatively large coefficient. This implies that if the profitability ratio increases by one hundred percent, the bond ratio decreases by approximately 26%. For the squared variable of size, indicating a non-linear relationship, the interpretation of the coefficient is more difficult. Unlike a linear relationship, the effect on the bond ratio changes based on the specific value of squared size. If the value for squared size is located before the peak of the bell-shape, an additional unit increases the bond ratio. In contrast, if the value is located after the peak, an additional unit of squared size decreases the bond ratio.

The results imply that larger firms have a lower bond ratio. At first glance, this relationship seems counterintuitive as larger firms should benefit from a better access to the bond market, economies of scale in issuing bonds, and a lower need for tailor-made financing (ICMA 2013; McKinsey Global Institute 2018). Historically, bond markets were limited to large corporations only due to a very high cost of issuance, however the range of issuers who have access to the market has broadened (ICMA 2013). A possible explanation for the inverse relationship of the bond ratio and the size of a firm is provided by Colla et. al (2013) which state that "large, mature, profitable firms with more tangible assets, high leverage, and credit rating use multiple [debt] sources" (Colla et. al 2013). For my analysis, this implies that larger firms have multiple types of debt for financing and hence each debt source comprises a lower proportion of the total debt, driving down the bond ratio.

Studying and proving the non-linear relationship of the size of a firm with the level of bond ratio sheds new light on the relationship. The positive non-linear relationship of the two variables indicates a bell-shaped behavior implying that the bond ratio is low for very small and very large firms whereas it is high for firms with sizes that lie in the middle. Hence indeed, matching ex-

pectations, the bond ratio tends to be low for small firms as well which can probably be traced back to difficulties in accessing the corporate debt market due to missing requirements such as the existence of a debt rating, the fulfillment of a minimum issuance volume and the meeting of strict standards regarding the investment prospectus (Faulkender and Petersen 2006; Feihle and Lawrenz 2017). Yet, it is also lower for very big firms and conglomerates like General Electrics and Co. as they usually diversify their debt more, hence each debt type takes up a lower percentage of the debt structure (Appendix Table 10).

The negative relationship of the bond ratio with the profitability of a firm implies that more profitable firms have a lower proportion of their debt financed by outstanding bonds. This can again be explained by the previously mentioned findings of Colla et. al (2013) which state that more profitable firms use multiple debt sources (Colla et. al 2013), and hence the percentage of each debt type is lower. When reviewing the regression results, I found that the results are very consistent with the pecking order theory of capital structure. Especially for the regression where the dependent variable is market leverage (Appendix Table 9), the commonly applied capital structure measure, the determinants behave according to the theoretical impacts of the corporate capital structure pecking order theory (Hang et. al 2018).

According to the pecking order theory, the cost of financing increases with asymmetric information. Companies first prefer internal financing and then debt, lastly equity. The more earnings a company has, the more profitable it is and the less it has to rely on external funding like private and public debt (Myers and Majluf 1984). When a company faces the choice between private or public debt, there is less information asymmetry in private lending compared to the corporate debt market. Due to their closer relationship with the firms, banks and other private lenders are more effective at monitoring borrowers, and consequently have an informational advantage over lenders in the public debt market (Leland and Pyle 1977; Diamond 1984; Fama 1985; Abad et. al 2017). Hence, according to the pecking order theory which aims to reduce asymmetric information, private lending is preferred over public lending which explains the lower bond ratio for profitable firms (see Figure 1). Those profitable firms would first try to meet their financial needs with re-

tained earnings, from which they have more available than less profitable companies, or bank debt. For less profitable firms, the financial lending in the corporate debt market is higher because their capacity of internal funds is used up earlier and they also get granted fewer private debt as they provide less security and higher that of default to banks. Of course, this explanation is only valid to a certain degree of lower profits, not implying firms which are close to default. Further, this only holds true as long as issuing bonds is cheaper than borrowing a bank loan.

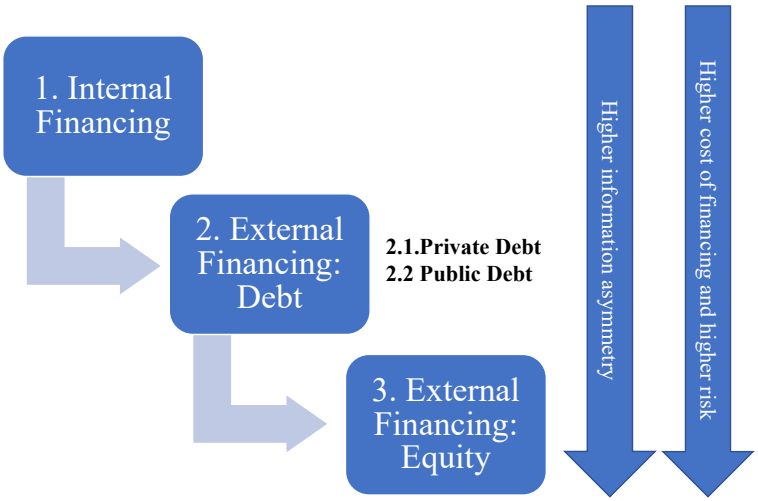

Figure 1: Pecking order theory

The market-to-book value is negatively related to the proportion of outstanding bonds in the debt structure which implies that firms with more growth opportunities finance themselves with fewer bonds. This pattern can be explained by the findings of Hadlock and James (2002) who ask why some firms borrow from public sources while others borrow from banks. They find that undervalued firms tend to borrow from banks because banks have the ability to accurately price financial claims and thus alleviate any information asymmetry problem. In short, the information benefit of bank debt finance pushes undervalued firms towards financing with private debt which is another link to the idea of the pecking order theory discussed above (Hadlock and James 2002). The authors also establish this link to the pecking order theory and refer to the prior work of MacKie-Mason (1989) who proposes a modified approach to theory in which firms prefer retained earnings

over new share issues and private debt over public debt when information problems are severe (Hadlock and James 2002). Gomes and Phillips (2012) also refer to Myers and Majluf's (1984) pecking order theory to explain why undervalued firms may refrain from raising finance. They argue that this occurs due to the dilution cost of selling underpriced securities. Other researches, Morellec et. al (2015), examine the choice between bonds and bank loans and their relation to corporate investment. They find that firms with more growth options, equaling a higher-market-to-book value, are more likely to issue bonds. Further, the authors state that those are the firms which accelerate investment (Morellec et. al 2015).

The negative relationship for the bond ratio with market leverage can be placed in line with the previous explanations. The more leverage a firm has in its capital structure, the lower is the bond ratio as the debt structure is more diversified (Colla et. al 2013).

The effect that higher cash-holdings on the balance sheet are associated with a higher bond ratio can be explained by the fact that cash-holdings provide safety to potential investors. Those firms who provide more safety to their investors also attract more investors and hence can issue more bonds. The idea behind is that investors also consider the possibility that a company may default on its debt and hence consider higher cash-holdings a security for less credit or default risk. Colla et. al (2013) likewise found a positive relationship between the degree of debt specialization and cash-holdings which would mean a higher bond ratio for more cash-holdings following my earlier argumentation of debt diversification.

The dummy variable IG is significant and positive for specifications (1)(2)(4)(5), however not significant for columns where I account for firm fixed-effects. Hence, the reason why firms change their issue behaviour when they are rated investment-grade is firm-specific. That implies that some firms change their issuance behaviour if they are rated investment-grade and some do not. A further explanation for the positive relation of rating and bond ratio, which was already indicated in the time-series graphs in Figure 7 and Figure 8 in the Appendix, is that the main difference between bonds and bank debt is the monitoring function of banks (Rauh and Sufi 2010). According to Rauh and Sufi (2010), banks can investigate the borrower's future profitability, whereas bondholders

always liquidate the borrower. In their model, high-quality firms do not value the ability of banks to investigate and therefore rely primarily on arms-length type of debt to avoid additional cost of bank debt associated with monitoring.

The control variable GFC shows a similar pattern to the variable IG. The positive relationship with the dummy variable GFC indicates that the bond ratio of firms after the Great Financial Crisis tends to be higher. This is in line with the motivation of this study, namely the push towards the bond market after the Great Financial Crisis when bank credit was restricted. A further explanation for the very recent and future trend of rising bond financing comes from the previously mentioned Financial Times Article of 2009. Companies choose bonds for cheap funds favoured by the currently low-interest rates and increasing inflows into fixed-income funds. While the cost of capital for banks is increasing, the cost of bond market funding is at an all-time low for some companies (Sakoui and Bullock 2009). However, the relationship is not true for specification in column (6) where I account for firm-quarter fixed-effects, hence the reason why firms change their issue activity post-crisis is firm-specific, which means some firms change their issuance behaviour post-crisis and some do not.

The latter finding of firm-specific effects was motivation to undertake further analysis and to investigate the post-crisis issuances and the investment-grade firms subsample more closely. Specifically, I sorted all firm-quarter observations with investment-grade rating by highest bond ratio and then defined the data set into quintiles. The goal is to get a first understanding of why and which firms with investment-grade rating issue more bonds in order to reveal firm-specific patterns. The pattern in Appendix Table 11 provides an indication that for those quintiles with a higher bond ratio, firms have a higher market-to-book value, a lower market leverage and a higher cash-holding. It is important to note that the relationships for market leverage and cash-holdings are in line with the previously discussed regressions results which is not the case for the market-to-book value. In search for a better understanding of the firm-specific pattern, I had a closer look at the sub-sample for investment-grade firms and found that there exists a lot of homogeneity for

firms that show a high bond ratio. Namely, many firms with very high bond ratios show the same debt structure, for example a bond ratio equal to one hundred percent, for almost the entire sample period. For lower bond ratios, in contrast, there exists more heterogeneity of the bond ratio in firms. This provides an explanation of the firm-specific effect in the control variable IG, observed by the insignificant effect for the specifications (3) and (6) in the main regression in Table 1. For the subsample including only post-crisis observations, I follow the same approach and define the sorted bond ratios into quintiles. A similar pattern regarding the relationships of the control variables is observable, however, no specific structure in the subsample was detected to explain the firm-specific effects.

As no satisfying explanation for the firm-specific effects for the dummy variable GFC was found, the next subsection will conduct analysis with placing special focus on the period before and after the financial crisis.

3.2.1 Further analysis with a focus on the time period before and after the financial crisis

In this section, I study the control variables which explain the level of bond ratio by taking into account the interaction of the dummy variable GFC. The intention behind this analysis is to study whether the relationship of my dependent variable of interest bond ratio and the control variables is influenced by a third variable, in this case whether we look at the time period before or after the financial crisis.

Table 2 shows that with the interaction of the dummy variable GFC, only the control variable tangibility of a firm is consistently and highly significant with a positive relation. This implies that the positive relationship of the bond ratio and the tangibility of a firm is influenced by whether the observation occurs before the financial crisis or after.

For a more thorough analysis, I run separate regressions for the subsample with observations before the financial crisis and another regression for the time period after (Table 3 and Table 4). For the time before the financial crisis, the tangibility of a firm is negatively related and significanft for specifications (1)(2)(4)(5) with no fixed-effects, quarter fixed-effects or industry fixed-effects

Table 1

Bond ratio and firm characteristics

This table represents the main regression outputs namely the regressions of firm-characteristics on the level of bond ratio (dependent variable) of that firm. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

	BOND RATIO					
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Profitability	−0.332*	−0.360*	−0.194*	−0.232*	−0.276*	−0.151*
	(0.189)	(0.198)	(0.111)	(0.180)	(0.190)	(0.096)
Size	−0.148***	−0.149***	−0.271***	−0.151***	−0.151***	−0.263***
	(0.023)	(0.023)	(0.042)	(0.023)	(0.023)	(0.043)
$Size^2$	0.006***	0.006***	0.011***	0.006***	0.006***	0.010***
	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)
Market-to-book value	−0.050***	−0.048***	−0.057***	−0.052***	−0.049***	−0.063***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
Market leverage	−0.797***	−0.799***	−0.558***	−0.734***	−0.735***	−0.566***
	(0.042)	(0.042)	(0.048)	(0.043)	(0.043)	(0.051)
Dividends	0.000	0.000	−0.023**	0.001	0.001	−0.026**
	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)	(0.010)
Tangibility	0.002	0.002	0.136**	−0.075**	−0.075**	0.146**
	(0.028)	(0.028)	(0.063)	(0.032)	(0.033)	(0.062)
Cash-flow	−0.025	−0.022	0.092**	−0.001	0.011	0.072*
	(0.076)	(0.089)	(0.046)	(0.071)	(0.084)	(0.043)
Cash-holdings	0.169***	0.165***	0.187***	0.189***	0.186***	0.173***
	(0.022)	(0.022)	(0.019)	(0.021)	(0.022)	(0.020)
IG	0.041***	0.040***	0.003	0.051***	0.050***	0.020
	(0.015)	(0.015)	(0.027)	(0.015)	(0.015)	(0.028)
GFC	0.022***	0.026***	0.071***	0.015*	0.027***	−0.005
	(0.008)	(0.003)	(0.010)	(0.008)	(0.003)	(0.004)
Firm FE	NO	NO	YES	NO	NO	YES
Quarter FE	NO	YES	NO	NO	YES	YES
Industry FE	NO	NO	NO	YES	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	51,261	51,261	51,261	51,261	51,261	51,261
R^2	0.188	0.189	0.666	0.203	0.204	0.669
Adjusted R^2	0.187	0.188	0.652	0.203	0.203	0.655

and positively related for specifications (3) and (6), accounting for firm fixed-effects. Hence, this relationship again proves the firm-specific effect of the control variable GFC which is likewise observed in the main regression without interaction (Table 1).

What conclusion can we draw from this analysis with interaction? Overall, on a broader scope before the financial crisis, the higher tangibility of firms is associated with a lower bond ratio, whereas on the firm-level, a higher tangibility results in a higher level of bond ratio. In many studies, tangibility is considered a measure for bankruptcy risk, for example in the paper of Colla et. al (2013). The researchers found a consistent and negative relationship of asset tangibility, in line with our non-firm level results in columns (1),(2),(4), and (5). They argue that firms with higher bankruptcy risk, implying a lower tangibility, specialize in one type of debt to reduce negotiation costs, which would mean a higher bond ratio for my analysis (Colla et. al 2013). For the positive relationship with tangibility before the financial crisis on the more narrow firm-level, I provide the following explanation. Considering individual firm choices, those firms with more tangibility, equaling to lower bankruptcy risk, provide more security to investors, show lower credit risk and hence can issue more bonds than less tangible companies as they attract more investors.

With the goal to find a change in patterns for the period before and after the Great Financial Crisis apart from the previously analyzed variable Tangibility, I compare the respective regression results focusing on the main differences in Table 3 and Table 4.

For both time periods, the negative relationship of the bond ratio with, size, market-to-book value and market leverage and the positive relationship with cash holdings are the most decisive factors. This confirms the robustness and the relevance of the control variables for my entire research. Also, market leverage, cash-holdings and size show the highest impact in terms of coefficients, likewise to the main regression in Table 1. It is important to stress out that the effect of whether a firm is investment-grade or not (IG) became more decisive, that means gained in significance, after the GFC, and still drops out for firm fixed-effects. This fosters the picture that whether an investment-grade firm issues a higher bond ratio is firm-specific which was already prevalent in

Table 2

Bond ratio and firm characteristics with GFC interaction

This table represents another main regression output, namely the regressions of firm-characteristics on the level of bond ratio (dependent variable) of that firm with the interaction of the financial crisis dummy variable (GFC). Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

	BOND RATIO					
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Profitability*GFC	−0.389	−0.379	−0.248	−0.157	−0.155	−0.147
	(0.343)	(0.356)	(0.239)	(0.320)	(0.332)	(0.226)
Size*GFC	−0.007	−0.007	−0.006	−0.010	−0.010	−0.014
	(0.032)	(0.032)	(0.035)	(0.031)	(0.031)	(0.035)
$\text{Size}^2 * GFC$	0.001	0.001	0.002	0.001	0.001	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Market-to-book value*GFC	0.022	0.020	0.054***	0.025*	0.024*	0.049***
	(0.014)	(0.015)	(0.013)	(0.014)	(0.014)	(0.014)
Market leverage*GFC	−0.061	−0.057	0.102	−0.084	−0.082	0.086
	(0.062)	(0.062)	(0.061)	(0.060)	(0.061)	(0.062)
Dividends*GFC	0.030*	0.030*	0.053***	0.028	0.028	0.050***
	(0.017)	(0.017)	(0.016)	(0.017)	(0.017)	(0.017)
Tangibility*GFC	0.159***	0.158***	0.098**	0.136***	0.135***	0.098***
	(0.037)	(0.038)	(0.037)	(0.037)	(0.038)	(0.037)
Cash-flow*GFC	0.165	0.182	0.043	0.167	0.182	0.091
	(0.122)	(0.143)	(0.095)	(0.110)	(0.130)	(0.094)
Cash-holdings*GFC	−0.056*	−0.049	−0.105***	−0.069**	−0.064**	−0.092***
	(0.032)	(0.033)	(0.029)	(0.031)	(0.032)	(0.030)
IG*GFC	0.023	0.023	−0.031*	0.021	0.021	−0.031*
	(0.019)	(0.019)	(0.018)	(0.019)	(0.019)	(0.018)
Firm FE	NO	NO	YES	NO	NO	YES
Quarter FE	NO	YES	NO	NO	YES	YES
Industry FE	NO	NO	NO	YES	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	51,261	51,261	51,261	51,261	51,261	51,261
R^2	0.194	0.195	0.673	0.209	0.210	0.675
Adjusted R^2	0.193	0.194	0.659	0.208	0.209	0.661

the main regression (Table 1) where we had insignificant results for the specifications (3) and (6), accounting for firm fixed-effects. This stronger positive relationship for investment-grade firms after the financial crisis is conceptually in line with Appendix Figure 8 in which I plotted the development of the bond ratio separately for investment-grade and high-yield firms weighted by size and where the gap between the bond ratio of both groups became larger for the period after 2008.

Summed up, after the financial crisis, the rating of a firm was decisive on how high the level of bond ratio of a firm was, and the level of bond ratio behaves firm-specific.

To conclude the further analysis on the level of bond ratio with the focus on the financial crisis, it reveals a special role of the variable tangibility. The relationship of tangibility and bond ratio becomes significantly positive with the interaction of the dummy variable GFC, implying that the positive relationship of the bond ratio and the tangibility of a firm is influenced by whether the observation occurs before the financial crisis or after. In the period before the financial crisis, tangibility is further negatively related to broader fixed-effects whereas it is positively related to the bond ratio on the more narrow firm-level. Further, the separate regressions for the period before and after the financial crisis are robust to the regression on the overall sample, yet the variable indicating investment-grade becomes more decisive after the financial crisis.

Table 3

Bond ratio and firm characteristics before the Great Financial Crisis

This table represents regressions of firm-characteristics on the level of bond ratio (dependent variable) of that firm for the period before the financial crisis (2003 to 2010). Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

	BOND RATIO					
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Profitability	−0.189	−0.226	−0.021	−0.176	−0.221	−0.063
	(0.218)	(0.226)	(0.149)	(0.216)	(0.224)	(0.123)
Size	−0.126***	−0.125***	−0.188***	−0.126***	−0.125***	−0.137**
	(0.023)	(0.023)	(0.050)	(0.024)	(0.024)	(0.050)
$Size^2$	0.004***	0.004**	0.006	0.004***	0.004**	0.001
	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)
Market-to-book value	−0.060***	−0.056***	−0.073***	−0.063***	−0.059***	−0.058***
	(0.010)	(0.011)	(0.010)	(0.010)	(0.011)	(0.010)
Market leverage	−0.777***	−0.780***	−0.748***	−0.728***	−0.731***	−0.716***
	(0.049)	(0.049)	(0.055)	(0.049)	(0.050)	(0.059)
Dividends	−0.013	−0.013	−0.017	−0.013	−0.014	−0.021*
	(0.013)	(0.013)	(0.011)	(0.013)	(0.013)	(0.011)
Tangibility	−0.073***	−0.072**	0.152*	−0.100***	−0.098***	0.140*
	(0.028)	(0.028)	(0.076)	(0.034)	(0.034)	(0.074)
Cash-flow	−0.103	−0.113	0.074	−0.079	−0.082	0.045
	(0.084)	(0.090)	(0.062)	(0.082)	(0.091)	(0.042)
Cash-holdings	0.192***	0.185***	0.192***	0.210***	0.203***	0.156***
	(0.025)	(0.026)	(0.023)	(0.024)	(0.025)	(0.021)
IG	0.029*	0.028*		0.034**	0.033**	
	(0.016)	(0.016)	(0.000)	(0.016)	(0.016)	(0.000)
Firm FE	NO	NO	YES	NO	NO	YES
Quarter FE	NO	YES	NO	NO	YES	YES
Industry FE	NO	NO	NO	YES	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	26,653	26,653	26,653	26,653	26,653	26,653
R^2	0.223	0.225	0.741	0.228	0.231	0.747
Adjusted R^2	0.223	0.224	0.725	0.228	0.229	0.731

Table 4

Bond ratio and firm characteristics after the Great Financial Crisis

This table represents regressions of firm-characteristics on the level of bond ratio (dependent variable) of that firm for the period after the financial crisis (2010 to 2018). Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

	BOND RATIO					
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Profitability	−0.578**	−0.606*	−0.282*	−0.239*	−0.284*	−0.181*
	(0.287)	(0.301)	(0.159)	(0.256)	(0.270)	(0.132)
Size	−0.133***	−0.132***	−0.338***	−0.145***	−0.144***	−0.347***
	(0.035)	(0.035)	(0.069)	(0.034)	(0.034)	(0.068)
$Size^2$	0.005***	0.005**	0.013***	0.006***	0.006***	0.012***
	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)
Market-to-book value	−0.038***	−0.037***	−0.083***	−0.039***	−0.037***	−0.114***
	(0.012)	(0.013)	(0.012)	(0.012)	(0.013)	(0.012)
Market leverage	−0.838***	−0.837***	−0.573***	−0.782***	−0.780***	−0.660***
	(0.055)	(0.055)	(0.067)	(0.055)	(0.056)	(0.066)
Dividends	0.017	0.017	0.003	0.018	0.018	−0.001
	(0.015)	(0.015)	(0.012)	(0.014)	(0.014)	(0.013)
Tangibility	0.086**	0.086**	0.196**	−0.047	−0.047	0.194**
	(0.035)	(0.036)	(0.092)	(0.043)	(0.043)	(0.090)
Cash-flow	0.061	0.069	0.145*	0.085	0.100	0.166***
	(0.107)	(0.132)	(0.075)	(0.090)	(0.112)	(0.060)
Cash-holdings	0.136***	0.136***	0.106***	0.150***	0.149***	0.100***
	(0.028)	(0.028)	(0.021)	(0.028)	(0.028)	(0.021)
IG	0.052***	0.051**		0.064***	0.063***	
	(0.019)	(0.019)	(0.000)	(0.019)	(0.019)	(0.000)
Firm FE	NO	NO	YES	NO	NO	YES
Quarter FE	NO	YES	NO	NO	YES	YES
Industry FE	NO	NO	NO	YES	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	24,608	24,608	24,608	24,608	24,608	24,608
R^2	0.161	0.162	0.759	0.192	0.193	0.762
Adjusted R^2	0.161	0.160	0.745	0.192	0.192	0.748

3.3 Dynamic regression analysis on the change of bond ratio

Bonds have increasingly become important for financial stability (Mc Kinsey 2016) and are known to support economic growth of investors and in particular of companies (ICMA 2013). With increasingly issued corporate debt, there arises the question which companies should have access to the market. Albrizio et. al (2019), as referred to earlier, note an increased access of high-risk companies to the U.S. market between 2008 and 2016 (Albrizio et. al 2019). Regarding this development, it is crucial to understand what companies utilize their proceedings from corporate debt issuance for.

In this section, I am not interested in the level of bond ratio but in the effect of additional financing by bonds. In other words, I am seeking to understand the real effects of corporate financing by investigating whether the additional money raised from bonds is really invested to fund the businesses' needs and expansion. As previously stated, the motivation behind this analysis is whether one should allow firms easier access to the market also regarding the fact that historically bond financing was rather targeted to large companies (ICMA 2013). The answer for a broader access is yes if those firms invest the additional funding from bonds meaningfully and do not keep the additional raised money as cash reserves. The latter case would hinder opportunities for other firms in need of growth financing and would provide a disadvantage.

For the dynamic regressions, I calculate the change of bond ratio for subsequent observations which reduces the number of observations to 36,374 firm-quarters. Further, I introduce a new ratio measuring the investment activity of a firm in terms of capital expenditures. As a secondary study, I am also investigating investment in terms of change in total assets defined as variable Investment02.

$$\Delta Bond\ ratio_{it+1} = \frac{Bond\ ratio_{it_{+1}}}{Bond\ ratio_{it}} - 1 \tag{3}$$

$$Investment_{it} = \frac{Capital\ Expenditures_{it}}{Total\ Assets_{it}} \tag{4}$$

$$Investment02_{it} = \frac{Total\ Assets_{it}}{Total\ Assets_{it-1}} - 1 \tag{5}$$

The two other dependent variables I am interested in are cash-holdings and profitability. The three variables help me to examine whether firms that raise more bonds in their debt structure use these funds for meaningful and value-creating investment, whether they keep it as cash on their balance sheets and what effect the bond issuance has on the profitability of those firms. For each variable of interest, cash-holdings, investment, and profitability, I assess both industry-quarter fixed-effects in columns (1)(3)(5) and firm-quarter fixed-effects in columns (2)(4)(6) and use the variables size, market-to-book value, and tangibility as controls. The resulting regression equations are as follows where the indexes 'i' and 't' indicate firms and the year-quarters respectively:

$$\begin{aligned} Cash-holdings_{it+x} = \Delta Bond\ ratio_{it} + Size_{it-1} + Market-to-book\ value_{it-1} \\ + Tangibility_{it-1} \end{aligned} \tag{6}$$

$$\begin{aligned} Investment_{it+x} = \Delta Bond\ ratio_{it} + Size_{it-1} + Market-to-book\ value_{it-1} \\ + Tangibility_{it-1} \end{aligned} \tag{7}$$

$$\begin{aligned} Investment02_{it+x} = \Delta Bond\ ratio_{it} + Size_{it-1} + Market-to-book\ value_{it-1} \\ + Tangibility_{it-1} \end{aligned} \tag{8}$$

$$\begin{aligned} Profitability_{it+x} = \Delta Bond\ ratio_{it} + Size_{it-1} + Market-to-book\ value_{it-1} \\ + Tangibility_{it-1} \end{aligned} \tag{9}$$

In general, the impacts for the dynamic regressions are rather low and mainly visible after the third or fourth digit of the coefficients, yet the difference in magnitude is still mentionable. For that reason the coefficients for the following dynamic regression coefficients and standard errors are displayed times in 1,000 basis points.

For the dynamic regression with one-quarter time-lead for the dependent variables, the addi-

tional increase of the bond ratio has a positive, significant, consistent, and the highest effect on the investment activity of a firm (Appendix Table 13). In numbers, if the change in bond ratio increases by hundred percent, the investment ratio increases by roughly 0.25 basis points. Conversely, the change in bond ratio has a negative and consistent effect on the profitability of a firm, however with a lower magnitude. If the change in bond ratio increases by one hundred percent, the profitability of a firm decreases by roughly 0.15 basis points. The results for the relationship between change in bond ratio and cash-holdings are only positive and significant for the industry-fixed effects specification with a coefficient of 0.151. That implies that if the change in bond ratio increases by one hundred percent, the cash-holdings ratio decreases by 1.51 basis points. Similar to profitability, the result with cash-holdings shows a lower significance than the specifications with the dependent variable investments. The considered control variables were size, market-to-book value and tangibility.

Hence, the additional proportion of bonds in the debt structure has the largest and an immediate effect on the investment activity, followed by the profitability of a firm but with a lower magnitude in terms of significance. Such an effect is not observable for the variable cash-holdings. This proves that firms do not collect their additional funding as cash on the balance sheets but invest it in projects for future growth. The weaker negative relationship with profitability is naturally as issuing bonds affects earnings negatively in the short-term which will be further noticeable in the regression with two-quarters of time-lead where the profitability effect disappears (Appendix Table 14). In fact, Appendix Table 14 shows that bond financing has the most long-lasting effect on the investment behaviour of a firm as model (4) shows still significance at the 10% level. Again, the coefficients of 0.021 implies that if the change in bond ratio increases by 100%, the investment ratio increases by 0.2 basis points. For all the other specifications with the dependent variables profitability and cash-holdings, the results are not significant anymore. For the role of a firm's profitability this implies that, apart from the negative effect in the short-run, the additional money raised from bonds does not lead to profitability in the long-term, loosing in significance.

Further, it is interesting to note that the same regressions for the variable Investment02, de-

fined as the change in total assets rather than the capital expenditure over total assets, yield non-significant results (Appendix Table 15). This implies that the positive effect of bond financing on investment is only existing for investment that flows into research and development through capital expenditures.

These results provide very relevant insights to better understand the effect of the corporate bond market and to help policymakers to appropriately shape this market which shows significant scope for further growth. This growth should support firms in their investments and should be sustainable. While the effect of the level of bond ratio is positive and highly significant on the investment behaviour of a firm for roughly one subsequent quarter, the goal should be to also reach a long-term profitability effect for the financing with bonds for subsequent quarters. The weak effect on profitability could also be related to the previously mentioned fact of more high-risk companies, often the less profitable ones, entering the market. As a next step, I want to understand whether this pattern for the change in bond ratio on investment, cash-holdings, and profitability has changed over time.

3.3.1 Further analysis with focus on the time period before and after the financial crisis

Regarding a shift of the corporate bond market with the financial crisis and to maintain consistency in my analysis focus, I also want to understand for the dynamic regressions, which analyses the effect of additional financing with bonds, whether its observed pattern changes for the period before and after the Great Financial Crisis.

For the dynamic regression with one-quarter of time-lead for the dependent variables, only the relationship between an increase in the bond ratio and the investment of a firm before the financial crisis is consistently significant and positive (Appendix Table 16). The regression after the financial crisis does not show such a relation (Appendix Table 17). A very similar behaviour of the just described coefficients is observable for the following two time-leads as well, namely with two and three quarters (Appendix Table 18 to Table 21). Finally, the positive and significant effect on the change in bond ratio vanishes from four quarters time-lead onwards (Appendix Table 22 and 23).

The results show that the positive effect of the change in bond ratio on investment is only observable for the time before the financial crisis, is highly significant and lasts for roughly three firm-quarters in that time frame. For the time after the financial crisis, the variable investment does not show any significant relationship with the change in bond ratio across all tested time-leads. However, a slight indication, namely the fact that for the time-lead with one and three quarters after the financial crisis cash-holdings is significantly positive once at the industry-level and once at the firm-level respectively, reveals a preference for holding bond fundings as cash on the balance sheet instead of investing it. Hence, the results give an indication, but no ultimate proof, that after the financial crisis additional funding from bonds was rather held on the balance sheet as cash, albeit this relationship is not consistent for both firm-effects and industry-effects in the respective cases.

This development of less investment and more cash reserves with bond financing after the Great Financial Crisis makes historically sense. Before the crisis, with high interest-rates, investors opted for the public debt market only for very promising investment opportunities. After the crisis, with

easier and cheaper access to the market, not only investments were funded with bonds, but more and more funding from bonds was held as cash reserves.

This further analysis is a revealing extension of the dynamic regression encompassing the entire data sample. The just presented results show that the positive, albeit rather low effect of a change in bond ratio on investment behaviour is driven by the period before the financial crisis and not present after the financial crisis. Further, no positive effect on profitability is observed. These results should be of main importance for policymakers when considering how to open and shape the bond market in the future, especially with the currently observable trend of rising high-yield firms entering the market (Albrizio et. al 2019; Mc Kinsey 2018).

4 Conclusion

For the time period between 2003 and 2018, this study provides answers for the questions on how U.S. companies finance themselves, which firms finance themselves largely from the debt market, which determinants are relevant for that choice, and very importantly how companies are using the proceedings from corporate debt issuance.

The average bond ratio for the assessed sample is 69.2%, hence indicating heterogeneity in debt financing and showing that a substantial part of U.S. companies' debt is financed with bonds. Further, I show that firms which are less profitable, which have lower growth opportunities and lower leverage have a higher percentage of their debt financed by outstanding bonds. Conversely, firms with more cash reserves are associated with a higher bond ratio. I further prove a non-linear, bell-shaped, relationship of the size of a firm. Finally, my results reveal that the relationship between the dependent variable and the classification of whether a firm is investment-grade or not, and the distinction between the period before and after the GFC is positive but firm-specific.

The results are in line with the pecking order theory of capital structure which states that a firm's capital structure decisions are driven by the degree of information asymmetry. In particular, my argumentation is that firms with less internal funds will need to make more use of bond financing as their other capacities of financing internally and with bank debt are exhausted earlier.

Lastly and importantly, I was able to prove that additional capital raised from bonds has a negative impact on profitability in the short-term and a positive effect on the investment behaviour both in the short-term and long-term where investment is defined as capital expenditure over total assets. This relationship does not hold for investment defined as change in total assets. This implies that firms invest their money in growth opportunities and do not hold it as cash reserves on their balance sheets. Yet, this positive effect of Capex investment behaviour is only driven by the period before the financial crisis

These results should be especially relevant for policymakers to define the future of the bond market and to answer the question on which firms should have access to it. An important trend is the significant scope for future growth in the bond market but the decrease in issuer quality (Çelik

et. al 2019) as higher risk companies have more access to the corporate bond market (Albrizio et. al 2019). Hence, a potential extension of this research would be to place special focus on the rating of the firms, in specific the role of fallen angels in bond financing. If more investment-grade bonds are downgraded to high-yield, this might be difficult to absorb by the non-investment grade market and could potentially cause volatility and spreads to rise across the market (Çelik et. al 2019; Oxford Analytica 2019). It is important to understand what drives those firms to the bond market, for example if they are seeking to finance growth or to maintain cash for stability.

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6 Appendix

Table 5

Descriptive statistics for bond-issues for the entire Mergent's FISD data

This table presents the summary statistics for the bond-issues included in the entire Mergent's FISD Linking Table before matching to the Compustat financials. This gives a complete overview of the bond-issuance activity and development for the sample period. # Issues represents the number of bonds issued in that year. Offering amount is the sum of offering amounts for that year in billion dollars.

Year	# Issues	Offering amount	Year	# Issues	Offering amount
2003	4,973	717.356	2011	7,154	1037.887
2004	4,683	722.139	2012	9,432	1040.273
2005	3,713	684.421	2013	9,950	1098.198
2006	3,288	844.567	2014	10,503	1121.239
2007	4,113	991.600	2015	10,174	1311.146
2008	3,816	849.652	2016	10,008	1179.434
2009	3,150	977.301	2017	14,643	1133.401
2010	5,431	1007.636	2018	16,713	1025.170
			2019	5,852	594.627

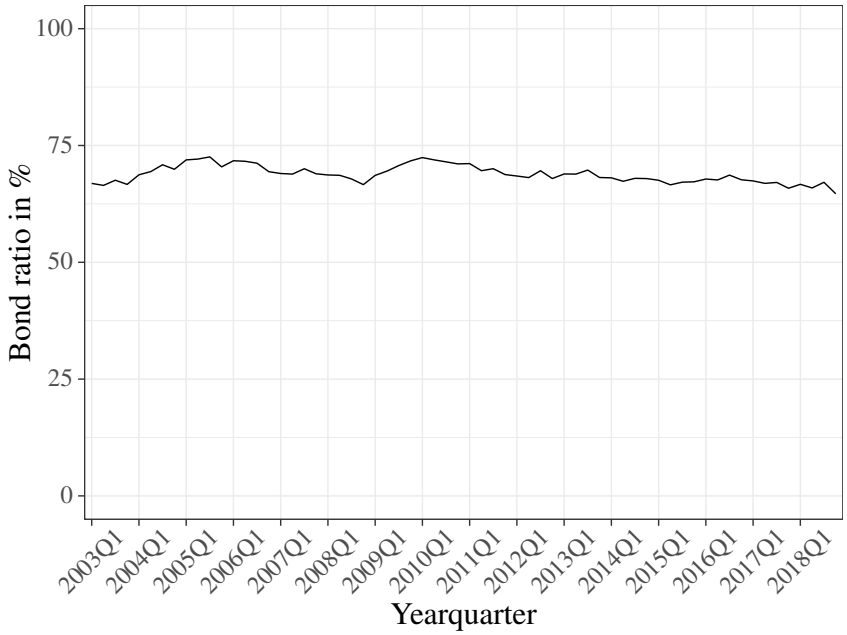

Figure 2: Development of the average bond ratio over the sample period

Table 6

Description of Variables

This table provides a description of the variables employed in the research paper. Firm characteristics are retrieved from the CRSP/Compustat Merged (CCM) database. Bond-issuance information for the variable 'Bond ratio' is taken from Mergent's Fixed Income Securities Database (FISD). All values are computed quarterly.

Variable	**Definition**
Bond ratio	Total debt divided by the sum outstanding bonds in that quarter
Profitability	Net income divided by total assets
Size	Logarithm of total assets
$Size^2$	Squared logarithm of total assets
Market-to-Book Value	Market value of the firm divided by the book value of the firm
Market leverage	Total debt divided by market the book value of the firm
Tangibility	Property, plant and equipment divided by total assets
Dividends	Dummy variable equal to 1 if the firm is estimated to pay dividends, and 0 otherwise
Cash-flow	EBIT + decpreciation and amortization divided by total assets
Cash-holdings	Cash and short-term investments divided by total assets
IG	Dummy variable equal to 1 if the firm has an investment grade rating and 0 otherwise
GFC	Dummy variable equal to 1 for the years from 2003 to 2010, and equal to 0 from 2010 to 2018
Investment	Capital expenditure divided by total assets
Investment02	Change in total assets divided by total assets

Table 7

Descriptive statistics for firm-characteristics

This table presents the summary statistics for the final sample of Compustat-leveraged firms. The sample covers U.S. firms from the time period 2003 to 2018 and excludes utility (SIC codes 4900-4999) and financial (SIC codes 6000-6999) firms. I removed (1) firm-quarters with missing or zero values for total assets (2) firm-quarters with missing or zero values for total debt (3) missing values for the control variables of interest. The data sample yields 51,261 firm-quarter observations. All ratios are winsorized at the 1% and 99% level. A definition of the variables is provided in Appendix Table 6.

Variable	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max	Unit of measurement
Bond ratio	51,261	0.692	0.284	0.002	0.472	0.985	1.000	Ratio
Total assets	51,261	13,886	33,501	2	1,351	11,336	534,870	Million Dollars
Total debt	51,261	4,014	10,176	0	402	3,450	190,167	Million Dollars
Profitability	51,261	0.010	0.017	−0.020	0	0.020	0.041	Ratio
Size	51,261	8.275	1.598	0.540	7.208	9.336	13.190	Natural logarithm
Market-to-book	51,261	1.345	0.579	0.047	0.879	1.760	2.370	Ratio
Market leverage	51,261	0.229	0.135	0	0.121	0.324	0.477	Ratio
Cash-flow	51,261	0.046	0.046	−0.043	0.017	0.077	0.126	Ratio
Cash-holdings	51,261	0.308	0.233	−0.128	0.107	0.476	0.752	Ratio
Tangibility	51,261	0.305	0.226	0.000	0.110	0.494	0.694	Ratio
Investment	51,261	0.025	0.019	−0.018	0.009	0.040	0.056	Ratio
Dividends	51,261	0.549	0.498	0	0	1	1	Dummy Variable
IG	51,261	0.292	0.455	0	0	1	1	Dummy Variable
GFC	51,261	0.480	0.500	0	0	1	1	Dummy Variable

Table 8

Descriptive statistics for bond-issues

This table presents the summary statistics for the bond-issues included in the final sample. The selection of bonds included in the sample follows the linking logic provided by the Wharton Research Data Services (WRDS). It ensures the correct matching of firm-characteristics and bonds by imposing a conservative date range to which a specific bond-issue can be linked. # Issues represents the number of bonds issued in that year. Offering amount is the sum of offering amounts for that year in billion dollars.

Year	# Issues	Offering amount	Year	# Issues	Offering amount
2003	394	116.038	2011	355	180.196
2004	371	99.545	2012	380	205.807
2005	288	105.426	2013	336	181.941
2006	244	114.049	2014	356	191.252
2007	311	144.08	2015	318	196.753
2008	196	141.224	2016	246	155.110
2009	282	150.776	2017	280	161.702
2010	368	166.965	2018	214	116.815

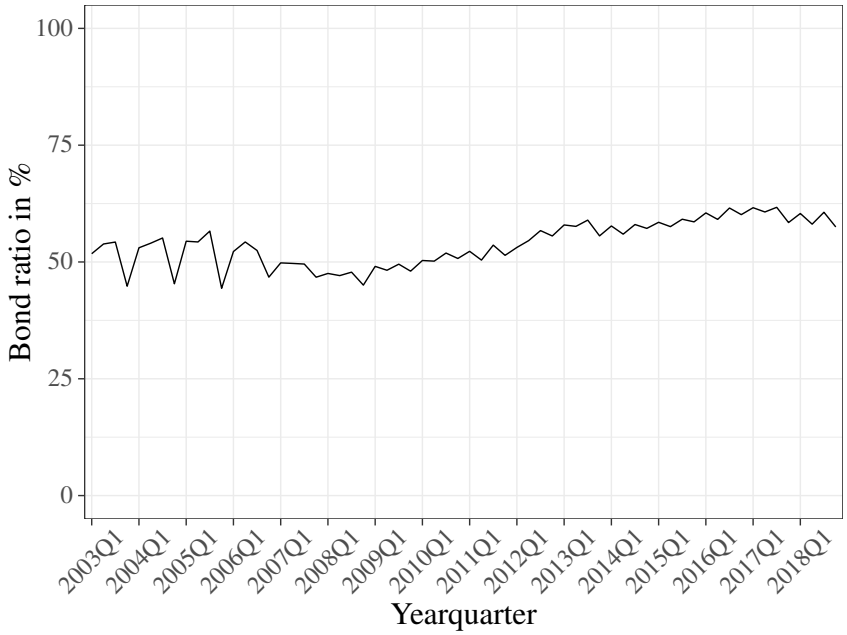

Figure 3: Development of the weighted average bond ratio over the sample period

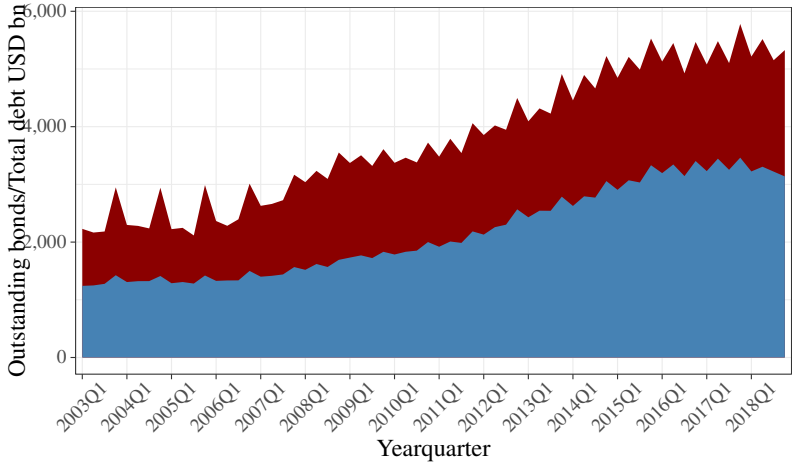

Figure 4: Proportion of total debt that is financed by outstanding bonds

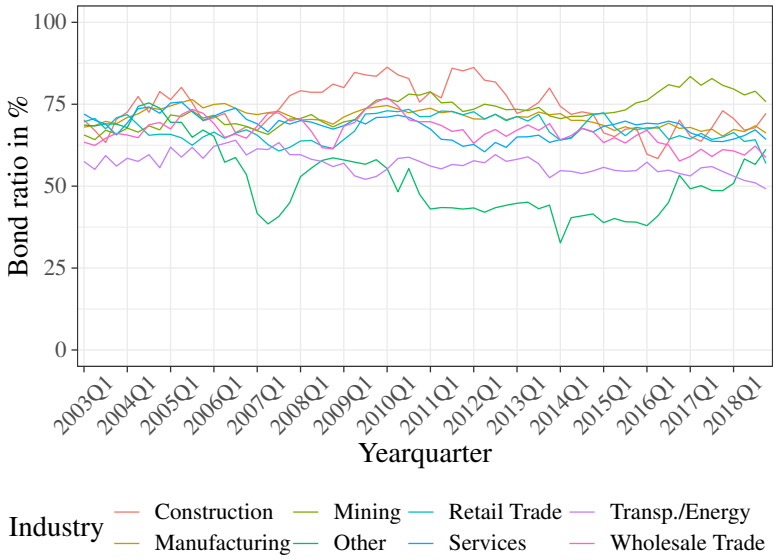

Figure 5: Development of the average bond ratio by industry over the sample period

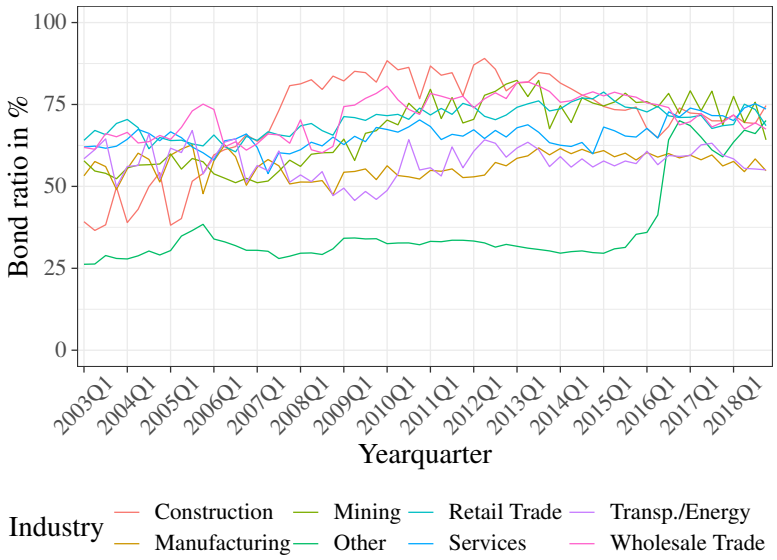

Figure 6: Development of the weighted average bond ratio by industry over the sample period

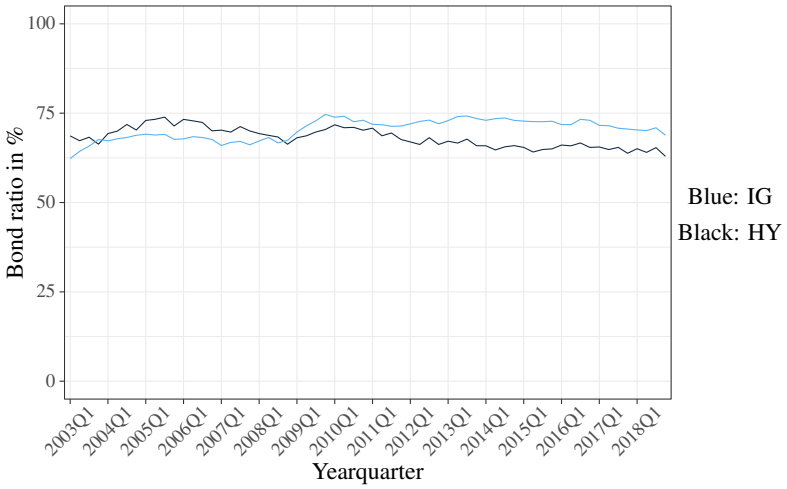

Figure 7: Development of the average bond ratio by IG over the sample period

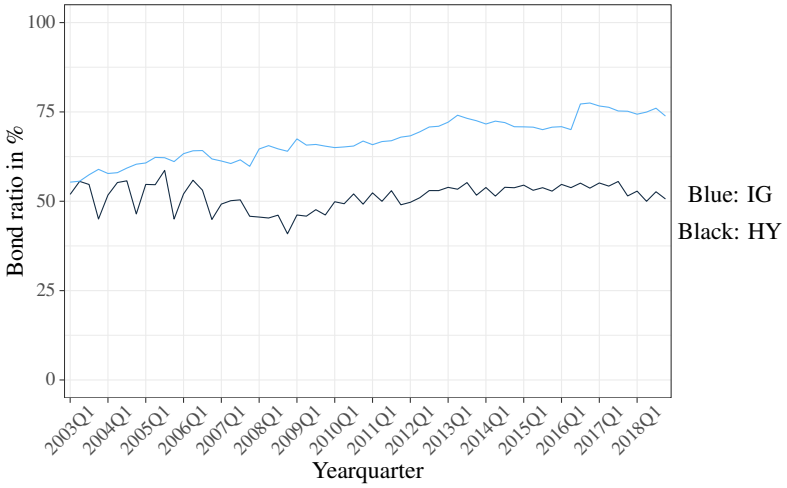

Figure 8: Development of the weighted average bond ratio by IG over the sample period

Table 9

Market leverage and firm characteristics

This table represents the regression outputs of firm-characteristics on the level of market leverage (dependent variable) of that firm. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

	Market leverage					
	(1)	(2)	(3)	(4)	(5)	(6)
Bond ratio	-0.121^{***}	-0.120^{***}	-0.060^{***}	-0.109^{***}	-0.107^{***}	-0.058^{***}
	(0.007)	(0.007)	(0.005)	(0.007)	(0.007)	(0.005)
Profitabiltiy	-1.351^{***}	-1.241^{***}	-0.716^{***}	-1.307^{***}	-1.184^{***}	-0.570^{***}
	(0.121)	(0.118)	(0.067)	(0.113)	(0.108)	(0.054)
Size	-0.028^{***}	-0.028^{**}	-0.089^{***}	-0.026^{**}	-0.025^{**}	-0.081^{***}
	(0.011)	(0.011)	(0.017)	(0.010)	(0.010)	(0.018)
$Size^2$	0.001	0.001	0.005^{***}	0.000	0.000	0.004^{***}
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Market-to-book value	-0.078^{***}	-0.077^{***}	-0.100^{***}	-0.075^{***}	-0.073^{***}	-0.100^{***}
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
Dividends	-0.023^{***}	-0.023^{***}	-0.007^{*}	-0.021^{***}	-0.021^{***}	-0.009^{**}
	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)
Tangibiltiy	0.116^{***}	0.118^{***}	0.077^{***}	0.103^{***}	0.105^{***}	0.062^{***}
	(0.010)	(0.010)	(0.022)	(0.012)	(0.012)	(0.022)
Cash-flow	-0.163^{***}	-0.194^{***}	-0.198^{***}	-0.182^{***}	-0.220^{***}	-0.236^{***}
	(0.040)	(0.042)	(0.030)	(0.039)	(0.040)	(0.021)
Cash-holdings	-0.028^{***}	-0.030^{***}	-0.009	-0.049^{***}	-0.051^{***}	-0.011
	(0.009)	(0.009)	(0.007)	(0.009)	(0.009)	(0.007)
IG	-0.004	-0.005	0.018^{*}	-0.008	-0.009	0.024^{**}
	(0.006)	(0.006)	(0.009)	(0.006)	(0.006)	(0.009)
GFC	0.025^{***}	-0.014^{***}	0.016^{***}	0.027^{***}	-0.012^{***}	0.001
	(0.004)	(0.001)	(0.005)	(0.004)	(0.001)	(0.001)
Firm FE	NO	NO	YES	NO	NO	YES
Quarter FE	NO	YES	NO	NO	YES	YES
Industry FE	NO	NO	NO	YES	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	51,261	51,261	51,261	51,261	51,261	51,261
R^2	0.456	0.462	0.842	0.480	0.487	0.851
Adjusted R^2	0.456	0.461	0.835	0.479	0.486	0.845

Table 10

Cluster analysis

The k-means clustering approach aims to minimize within-cluster variances, that means the squared Euclidean distances of a firm-year observation from the center of its own cluster. It further maximizes the variances between those clusters. Applying the elbow method to determine the optimal number of clusters, R- Statistics yields four final clusters for the data set. With this approach, the within-cluster sum of squares are plotted for different values of clusters. The location of a bend, or knee, in the plot is a good indicator of the appropriate number of clusters (Kaufman and Rousseeuw 1990; Everitt and Hothorn 2005).

	Obs.	Bond ratio	Profitability	Size	Market-to-book	Market leverage	Dividends	Tangibility	Cash-flow	Cash-holdings	IG	GFC
Cluster 1	43,534	Min. :0.0023	Min. :-0.0200	Min. : 0.54	Min. :0.05	Min. :1.6e-05	Min. :0.00	Min. :0.00	Min. :-0.043	Min. :-0.128	Min. :0.00	Min. :0.00
Cluster 1	43,534	1st Qu.:0.4761	1st Qu.:-0.0020	1st Qu.: 7.02	1st Qu.:0.88	1st Qu.:1.3e-01	1st Qu.:0.00	1st Qu.:0.11	1st Qu.: 0.015	1st Qu.: 0.099	1st Qu.:0.00	1st Qu.:0.00
Cluster 1	43,534	Median :0.7480	Median : 0.0094	Median : 7.92	Median :1.21	Median :2.1e-01	Median :0.00	Median :0.23	Median : 0.039	Median : 0.245	Median :0.00	Median :0.00
Cluster 1	43,534	Mean :0.6970	Mean : 0.0086	Mean : 7.83	Mean :1.35	Mean :2.4e-01	Mean :0.49	Mean :0.30	Mean : 0.043	Mean : 0.308	Mean :0.26	Mean :0.46
Cluster 1	43,534	3rd Qu.:0.9931	3rd Qu.: 0.0197	3rd Qu.: 8.79	3rd Qu.:1.77	3rd Qu.:3.4e-01	3rd Qu.:1.00	3rd Qu.:0.48	3rd Qu.: 0.075	3rd Qu.: 0.486	3rd Qu.:1.00	3rd Qu.:1.00
Cluster 1	43,534	Max. :1.0000	Max. : 0.0408	Max. :10.05	Max. :2.37	Max. :4.8e-01	Max. :1.00	Max. :0.69	Max. : 0.126	Max. : 0.752	Max. :1.00	Max. :1.00
	Obs.	Bond ratio	Profitability	Size	Market-to-book	Market leverage	Dividends	Tangibility	Cash-flow	Cash-holdings	IG	GFC
Cluster 2	6,026	Min. :0.0023	Min. :-0.0200	Min. : 9.9	Min. :0.047	Min. :0.0014	Min. :0.00	Min. :0.0089	Min. :-0.043	Min. :0.00	Min. :0.0	Min. :0.00
Cluster 2	6,026	1st Qu.:0.5424	1st Qu.: 0.0073	1st Qu.:10.2	1st Qu.:0.891	1st Qu.:0.1057	1st Qu.:1.00	1st Qu.:0.1199	1st Qu.: 0.028	1st Qu.:0.15	1st Qu.:0.0	1st Qu.:0.00
Cluster 2	6,026	Median :0.7910	Median : 0.0146	Median :10.4	Median :1.200	Median :0.1575	Median :1.00	Median :0.2937	Median : 0.054	Median :0.27	Median :1.0	Median :1.00
Cluster 2	6,026	Mean :0.7146	Mean : 0.0150	Mean :10.5	Mean :1.338	Mean :0.1816	Mean :0.85	Mean :0.3419	Mean : 0.059	Mean :0.30	Mean :0.5	Mean :0.59
Cluster 2	6,026	3rd Qu.:0.9654	3rd Qu.: 0.0239	3rd Qu.:10.7	3rd Qu.:1.723	3rd Qu.:0.2339	3rd Qu.:1.00	3rd Qu.:0.5791	3rd Qu.: 0.090	3rd Qu.:0.43	3rd Qu.:1.0	3rd Qu.:1.00
Cluster 2	6,026	Max. :1.0000	Max. : 0.0408	Max. :11.4	Max. :2.370	Max. :0.4773	Max. :1.00	Max. :0.6943	Max. : 0.126	Max. :0.75	Max. :1.0	Max. :1.00
	Obs.	Bond ratio	Profitability	Size	Market-to-book	Market leverage	Dividends	Tangibility	Cash-flow	Cash-holdings	IG	GFC
Cluster 3	1,345	Min. :0.0033	Min. :-0.0200	Min. :11	Min. :0.30	Min. :0.0045	Min. :0.00	Min. :0.011	Min. :-0.043	Min. :0.023	Min. :0.0	Min. :0.00
Cluster 3	1,345	1st Qu.:0.2265	1st Qu.: 0.0078	1st Qu.:12	1st Qu.:0.82	1st Qu.:0.1084	1st Qu.:1.00	1st Qu.:0.121	1st Qu.: 0.033	1st Qu.:0.202	1st Qu.:0.0	1st Qu.:0.00
Cluster 3	1,345	Median :0.4838	Median : 0.0156	Median :12	Median :1.18	Median :0.1535	Median :1.00	Median :0.191	Median : 0.060	Median :0.310	Median :1.0	Median :1.00
Cluster 3	1,345	Mean :0.4985	Mean : 0.0158	Mean :12	Mean :1.29	Mean :0.1786	Mean :0.91	Mean :0.277	Mean : 0.065	Mean :0.351	Mean :0.5	Mean :0.66
Cluster 3	1,345	3rd Qu.:0.7623	3rd Qu.: 0.0239	3rd Qu.:12	3rd Qu.:1.68	3rd Qu.:0.2234	3rd Qu.:1.00	3rd Qu.:0.457	3rd Qu.: 0.095	3rd Qu.:0.482	3rd Qu.:1.0	3rd Qu.:1.00
Cluster 4	1,345	Max. :1.0000	Max. : 0.0408	Max. :12	Max. :2.37	Max. :0.4773	Max. :1.00	Max. :0.694	Max. : 0.126	Max. :0.752	Max. :1.0	Max. :1.00
	Obs.	Bond ratio	Profitability	Size	Market-to-book	Market leverage	Dividends	Tangibility	Cash-flow	Cash-holdings	IG	GFC
Cluster 4	353	Min. :0.013	Min. :-0.020	Min. :12	Min. :0.45	Min. :0.0051	Min. :0.00	Min. :0.069	Min. :-0.043	Min. :0.044	Min. :0.000	Min. :0.00
Cluster 4	353	1st Qu.:0.254	1st Qu.: 0.006	1st Qu.:12	1st Qu.:0.75	1st Qu.:0.1144	1st Qu.:1.00	1st Qu.:0.241	1st Qu.: 0.035	1st Qu.:0.179	1st Qu.:0.000	1st Qu.:1.00
Cluster 4	353	Median :0.464	Median : 0.011	Median :12	Median :0.88	Median :0.2123	Median :1.00	Median :0.382	Median : 0.061	Median :0.290	Median :0.000	Median :1.00
Cluster 4	353	Mean :0.495	Mean : 0.012	Mean :13	Mean :1.05	Mean :0.2244	Mean :0.96	Mean :0.392	Mean : 0.066	Mean :0.303	Mean :0.096	Mean :0.79
Cluster 4	353	3rd Qu.:0.729	3rd Qu.: 0.018	3rd Qu.:13	3rd Qu.:1.15	3rd Qu.:0.3256	3rd Qu.:1.00	3rd Qu.:0.539	3rd Qu.: 0.093	3rd Qu.:0.378	3rd Qu.:0.000	3rd Qu.:1.00
Cluster 4	353	Max. :1.000	Max. : 0.041	Max. :13	Max. :2.37	Max. :0.4773	Max. :1.00	Max. :0.694	Max. : 0.126	Max. :0.752	Max. :1.000	Max. :1.00

Table 11

Data sample grouped into bond ratio quintiles for IG

In order to investigate which firms issue more within those which are IG rated

Quintiles	Bond ratio	Profitability	Size	Market-to-book	Market leverage	Dividends	Tangibility	Cash-flow	Cash-holdings	GFC
1	0.289	0.016	8.851	1.431	0.233	0.788	0.285	0.056	0.215	0.436
2	0.568	0.018	8.986	1.576	0.181	0.828	0.275	0.063	0.215	0.467
3	0.760	0.019	9.236	1.603	0.169	0.892	0.277	0.066	0.214	0.532
4	0.923	0.020	9.194	1.622	0.137	0.873	0.245	0.068	0.261	0.536
5	1.000	0.020	8.819	1.624	0.119	0.788	0.202	0.066	0.358	0.500

Table 12

Data sample grouped into bond ratio quintiles for the post-crisis period

In order to investigate which firms issue more bonds post-crisis

Quintiles	Bond ratio	Profitability	Size	Market-to-book	Market leverage	Dividends	Tangibility	Cash-flow	Cash-holdings	IG
1	0.238	0.007	8.836	1.197	0.306	0.561	0.319	0.041	0.276	0.218
2	0.517	0.008	8.534	1.350	0.258	0.568	0.317	0.044	0.284	0.262
3	0.732	0.011	8.836	1.394	0.228	0.668	0.324	0.052	0.271	0.376
4	0.961	0.010	8.483	1.454	0.188	0.604	0.280	0.046	0.370	0.324

Table 13

Dynamic Regression Model (t+1)

This table represents dynamic regression models to measure the prediction of the change in the bond ratio on cash-holdings, investment, and profitability. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively. Coefficients and standard errors are displayed in 1,000 basis points.

	Cash-holdings		Investment		Profitability	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Bond ratio	0.151^{*}	0.086	0.025^{***}	0.023^{***}	-0.016^{*}	-0.013^{*}
	(0.073)	(0.104)	(0.007)	(0.007)	(0.008)	(0.007)
Size	-18.438^{***}	-7.787^{***}	0.479^{***}	0.505^{*}	2.969^{***}	-0.807^{***}
	(3.099)	(2.439)	(0.169)	(0.274)	(0.339)	(0.190)
Market-to-book value	92.534^{***}	7.041^{*}	3.512^{***}	4.119^{***}	10.326^{***}	8.600^{***}
	(19.013)	(4.060)	(0.705)	(0.635)	(0.733)	(0.924)
Tangibility	−43.595	-42.156^{***}	42.347^{***}	2.742^{*}	2.529	0.188
	(72.617)	(15.624)	(3.307)	(1.412)	(2.219)	(1.309)
Firm FE	NO	YES	NO	YES	NO	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	NO	YES	NO)	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	36,374	36,374	36,374	36,374	36,374	36,374
R^2	0.142	0.725	0.414	0.653	0.202	0.472
Adjusted R^2	0.141	0.709	0.413	0.633	0.201	0.442

Table 14

Dynamic Regression Model (t+2)

This table represents dynamic regression models to measure the prediction of the change in the bond ratio on cash-holdings, investment and profitability. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively. Coefficients and standard errors are displayed in 1,000 basis points.

	Cash-holdings		Investment		Profitability	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Bond ratio	0.041	−0.051	0.021	0.017*	−0.005	−0.001
	(0.057)	(0.079)	(0.013)	(0.009)	(0.005)	(0.010)
Size	−17.855***	−7.292***	0.412*	0.110	2.797***	−1.172***
	(2.835)	(2.386)	(0.216)	(0.193)	(0.318)	(0.281)
Market-to-book value	84.320***	−0.538	3.384***	4.048***	9.261***	6.097***
	(17.838)	(4.417)	(0.776)	(0.644)	(0.680)	(0.756)
Tangibility	−40.160	−16.922	39.709***	−0.695	2.120	−0.701
	(67.344)	(14.196)	(3.235)	(1.407)	(2.286)	(1.546)
Firm FE	NO	YES	NO	YES	NO	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	NO	YES	NO	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	36,374	36,374	36,374	36,374	36,374	36,374
R^2	0.125	0.672	0.372	0.607	0.172	0.433
Adjusted R^2	0.123	0.653	0.371	0.585	0.171	0.400

Table 15

Dynamic Regression Models for Investment02 as change in Total Assets

This table represents different dynamic regression models to measure the prediction of the change in the bond ratio on investments defined as change in total assets. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively. Coefficients and standard errors are displayed in 1,000 basis points.

	Investment02					
	t+1	t+1	t+2	t+2	Before GFC (t+1)	After GFC (t+1)
Δ Bond ratio	0.015	−0.005	0.008	−0.015	0.042	−0.030
	(0.045)	(0.051)	(0.040)	(0.035)	(0.045)	(0.060)
Size	−18.533***	−1.387*	−16.905***	−1.501*	−17.502**	−18.077***
	(4.550)	(0.734)	(4.229)	(0.793)	(7.357)	(6.504)
Market-to-book-value	37.164***	27.024***	27.928***	23.375***	30.366***	38.368***
	(4.380)	(3.134)	(3.507)	(2.851)	(7.768)	(7.792)
Tangibility	8.252	5.814	9.558	5.218	24.575***	21.587
	(9.088)	(4.964)	(10.935)	(5.825)	(8.532)	(19.360)
Firm FE	NO	YES	NO	YES	YES	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	NO	YES	NO)	NO	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	36,374	36,374	36,373	36,373	18,902	17,470
R^2	0.102	0.026	0.094	0.022	0.134	0.141
Adjusted R^2	0.050	0.025	0.042	0.021	0.060	0.071

Table 16

Dynamic Regression Model (t+1) before the Great Financial Crisis

This table represents dynamic regression models to measure the prediction of the change in the bond ratio on cash-holdings, investment, and profitability for the period before the financial crisis. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively. Coefficients and standard errors are displayed in 1,000 basis points.

	Cash-holdings		Investment		Profitability	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Bond ratio	0.083	0.030	0.035**	0.025***	−0.014**	−0.010
	(0.108)	(0.039)	(0.013)	(0.006)	(0.005)	(0.011)
Size	−26.254***	−2.938**	0.472***	0.227	2.911***	−0.985***
	(3.851)	(1.421)	(0.122)	(0.248)	(0.407)	(0.340)
Market-to-book value	103.545***	5.545	3.776***	2.426***	9.704***	6.135***
	(15.366)	(4.647)	(0.642)	(0.713)	(0.668)	(1.149)
Tangibility	−45.392	−28.329*	38.494***	−2.891	2.155	1.191
	(79.333)	(15.679)	(3.550)	(2.119)	(3.045)	(1.344)
Firm FE	NO	YES	NO	YES	NO	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	NO	YES	NO)	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	18,902	18,902	18,902	18,902	18,902	18,902
R^2	0.157	0.741	0.379	0.637	0.185	0.488
Adjusted R^2	0.155	0.720	0.377	0.607	0.184	0.445

Table 17

Dynamic Regression Model (t+1) after the Great Financial Crisis

This table represents dynamic regression models to measure the prediction of the change in the bond ratio on cash-holdings, investment and profitability for the period after the financial crisis. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively. Coefficients and standard errors are displayed in 1,000 basis points.

	Cash-holdings		Investment		Profitability	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Bond ratio	0.200**	0.192	0.013	0.015	−0.014	−0.011
	(0.060)	(0.149)	(0.010)	(0.013)	(0.010)	(0.009)
Size	−10.044***	−6.484*	0.372*	0.410**	2.712***	−1.108***
	(2.747)	(3.599)	(0.202)	(0.208)	(0.362)	(0.222)
Market-to-book value	75.477***	1.943	2.920**	3.320***	9.708***	5.474***
	(20.000)	(7.135)	(1.333)	(0.791)	(0.839)	(1.299)
Tangibility	−43.721	−25.857*	41.626***	−1.190	2.980**	0.204
	(56.325)	(14.596)	(4.114)	(1.381)	(1.309)	(1.212)
Firm FE	NO	YES	NO	YES	NO	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	NO	YES	NO)	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	17,470	17,470	17,470	17,470	17,470	17,470
R^2	0.125	0.726	0.408	0.685	0.201	0.498
Adjusted R^2	0.123	0.703	0.407	0.659	0.199	0.456

Table 18

Dynamic Regression Model (t+2) before the Great Financial Crisis

This table represents dynamic regression models to measure the prediction of the change in the bond ratio on cash-holdings, investment and profitability for the period before the financial crisis. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively. Coefficients and standard errors are displayed in 1,000 basis points.

	Cash-holdings		Investment		Profitability	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Bond ratio	0.025	−0.023	0.027*	0.017**	−0.008***	−0.001
	(0.070)	(0.015)	(0.014)	(0.008)	(0.002)	(0.013)
Size	−26.349***	−5.336**	0.409***	−0.116	2.713***	−1.283***
	(3.487)	(2.317)	(0.140)	(0.215)	(0.376)	(0.463)
Market-to-book value	92.364***	−2.418	3.625***	2.613***	8.360***	3.234***
	(13.891)	(5.471)	(0.651)	(0.901)	(0.620)	(0.816)
Tangibility	−42.309	2.824	34.948***	−6.627***	2.392	1.644
	(67.959)	(15.649)	(3.421)	(2.419)	(3.083)	(1.665)
Firm FE	NO	YES	NO	YES	NO	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	NO	YES	NO)	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	18,901	18,901	18,901	18,901	18,901	18,901
R^2	0.134	0.666	0.330	0.579	0.151	0.442
Adjusted R^2	0.132	0.637	0.329	0.544	0.149	0.395

Table 19

Dynamic Regression Model (t+2) after the Great Financial Crisis

This table represents dynamic regression models to measure the prediction of the change in the bond ratio on cash-holdings, investment and profitability for the period after the financial crisis. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively. Coefficients and standard errors are displayed in 1,000 basis points.

	Cash-holdings		Investment		Profitability	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Bond ratio	0.047	−0.026	0.010	0.015	−0.018	−0.016
	(0.082)	(0.146)	(0.020)	(0.013)	(0.020)	(0.021)
Size	−9.435***	−4.982*	0.276	0.142	2.473***	−1.044***
	(2.680)	(2.626)	(0.202)	(0.225)	(0.317)	(0.368)
Market-to-book-value	67.567***	−4.517	2.715**	3.070***	8.496***	2.997**
	(18.744)	(7.171)	(1.343)	(0.917)	(0.824)	(1.235)
Tangibility	−40.715	−15.199	38.144***	−4.419***	2.710**	0.668
	(51.726)	(14.501)	(3.968)	(1.603)	(1.349)	(1.508)
Firm FE	NO	YES	NO	YES	NO	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	NO	YES	NO)	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	17,469	17,469	17,469	17,469	17,469	17,469
R^2	0.107	0.659	0.352	0.623	0.168	0.452
Adjusted R^2	0.105	0.632	0.351	0.592	0.167	0.407

Table 20

Dynamic Regression Model (t+3) before the Great Financial Crisis

This table represents dynamic regression models to measure the prediction of the change in the bond ratio on cash-holdings, investment and profitability for the period before the financial crisis. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively. Coefficients and standard errors are displayed in 1,000 basis points.

	Cash-holdings		Investment		Profitability	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Bond ratio	0.001	−0.036	0.050**	0.042***	−0.025***	−0.018
	(0.032)	(0.030)	(0.021)	(0.011)	(0.003)	(0.012)
Size	−25.831***	−3.237	0.366**	−0.315	2.541***	−1.444***
	(3.300)	(2.103)	(0.155)	(0.250)	(0.346)	(0.497)
Market-to-book-value	82.534***	−4.793	3.204***	1.935**	7.469***	1.842***
	(11.888)	(5.728)	(0.574)	(0.902)	(0.615)	(0.627)
Tangibility	−39.914	15.961	31.861***	−8.249**	2.601	1.652
	(59.738)	(21.404)	(3.536)	(3.237)	(3.148)	(1.533)
Firm FE	NO	YES	NO	YES	NO	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	NO	YES	NO)	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	18,900	18,900	18,900	18,900	18,900	18,900
R^2	0.114	0.614	0.284	0.536	0.128	0.416
Adjusted R^2	0.112	0.581	0.282	0.497	0.126	0.366

Table 21

Dynamic Regression Model (t+3) after the Great Financial Crisis

This table represents dynamic regression models to measure the prediction of the change in the bond ratio on cash-holdings, investment and profitability for the period after the financial crisis. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively. Coefficients and standard errors are displayed in 1,000 basis points.

	Cash-holdings		Investment		Profitability	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Bond ratio	0.246	0.146**	−0.015	−0.017	0.013	0.018
	(0.141)	(0.058)	(0.018)	(0.018)	(0.014)	(0.012)
Size	−8.820***	−2.790	0.205	0.247	2.243***	−1.424***
	(2.721)	(2.407)	(0.210)	(0.207)	(0.294)	(0.434)
Market-to-book value	59.346***	−14.719**	2.484**	2.677***	7.504***	1.556*
	(17.838)	(6.530)	(1.248)	(0.776)	(0.847)	(0.839)
Tangibility	−43.245	−34.422**	34.640***	−7.328***	2.057	−1.574
	(46.346)	(15.844)	(4.083)	(2.379)	(1.371)	(1.338)
Firm FE	NO	YES	NO	YES	NO	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	NO	YES	NO)	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	17,468	17,468	17,468	17,468	17,468	17,468
R^2	0.091	0.614	0.300	0.576	0.142	0.422
Adjusted R^2	0.089	0.582	0.299	0.541	0.140	0.374

Table 22

Dynamic Regression Model (t+4) before the Great Financial Crisis

This table represents dynamic regression models to measure the prediction of the change in the bond ratio on cash-holdings, investment and profitability for the period before the financial crisis. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively. Coefficients and standard errors are displayed in 1,000 basis points.

	Cash-holdings		Investment		Profitability	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Bond ratio	0.004	−0.031	0.008	0.001	−0.016***	−0.008
	(0.037)	(0.053)	(0.012)	(0.011)	(0.003)	(0.016)
Size	−25.324***	−1.448	0.350**	−0.416	2.339***	−1.912***
	(3.216)	(2.365)	(0.146)	(0.306)	(0.316)	(0.638)
Market-to-book value	72.338***	−10.406	2.773***	1.028	6.514***	0.268
	(11.488)	(7.757)	(0.550)	(0.679)	(0.619)	(0.583)
Tangibility	−37.494	35.568	28.976***	−11.378***	2.933	4.079***
	(51.897)	(25.405)	(3.558)	(2.747)	(2.856)	(1.559)
Firm FE	NO	YES	NO	YES	NO	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	NO	YES	NO)	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	18,899	18,899	18,899	18,899	18,899	18,899
R^2	0.097	0.575	0.242	0.503	0.107	0.395
Adjusted R^2	0.095	0.539	0.241	0.461	0.105	0.344

Table 23

Dynamic Regression Model (t+4) after the Great Financial Crisis

This table represents dynamic regression models to measure the prediction of the change in the bond ratio on cash-holdings, investment and profitability for the period after the financial crisis. Standard errors are clustered at the firm-quarter level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively. Coefficients and standard errors are displayed in 1,000 basis points.

	Cash-holdings		Investment		Profitability	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Bond ratio	0.0255	0.103	−0.030	−0.003	−0.027*	−0.017
	(0.187)	(0.097)	(0.017)	(0.020)	(0.008)	(0.010)
Size	−8.446***	−1.715	0.160	0.193	2.033***	−1.566**
	(2.966)	(2.564)	(0.228)	(0.283)	(0.291)	(0.613)
Market-to-book value	52.369***	−17.067**	2.260**	2.103***	6.634***	0.343
	(17.263)	(7.310)	(1.108)	(0.727)	(0.836)	(0.648)
Tangibility	−39.549	−14.197	31.586***	−11.738***	1.930	−0.211
	(40.523)	(14.827)	(4.046)	(2.470)	(1.247)	(1.543)
Firm FE	NO	YES	NO	YES	NO	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	NO	YES	NO)	YES	NO
Cluster	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Observations	17,467	17,467	17,467	17,467	17,467	17,467
R^2	0.077	0.577	0.254	0.541	0.119	0.403
Adjusted R^2	0.075	0.542	0.253	0.504	0.117	0.354